

# Safety and Handling of Ammonia

## Ammonia as a Future Energy Source

Ammonia is the second-largest chemical produced in the world. Ammonia has been produced, stored, and transported across continents for over 100 years. Today, about 80 percent of all ammonia produced is used in fertilizers to ensure global food production. Soon, ammonia will be applied in new ways, such as emission-free fuel for the international shipping industry, generating a need for new safety standards and procedures.

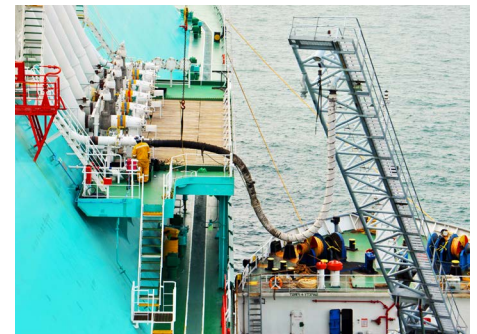
Ammonia, like many other valuable chemicals, requires careful and responsible handling due to its known hazardous properties. Exposure to high levels of ammonia is harmful and can cause serious health issues if exposure is prolonged. The strong, pungent odor of ammonia is a critical safety feature. Its distinct smell serves as an immediate warning sign, giving those involved in handling enough time to act and mitigate exposure risks before it can affect them and/or the surrounding community.

While ammonia is flammable, the likelihood of an explosion is relatively low. It comes down to the fact that a lot of ammonia and a strong spark are needed for it to ignite. Additionally, ammonia tends to burn slower than many other fuels, meaning it doesn't pose the same immediate threat. All recorded incidents of ammonia ignition are in an enclosed space where prolonged leak can accumulate.

Throughout the years, authorities and the chemical industry have collaboratively developed stringent regulatory frameworks and training programs to ensure ammonia's safe production, distribution, and use, significantly reducing industrial accidents. In navigating the diverse applications of ammonia—from its primary role in agriculture to emerging uses in sectors like shipping, leveraging the safety lessons learned and established best practices in safety risk management is crucial.

Cross-industry collaboration is a key enabler in developing safety regulations and standards for new ammonia applications. Today, to safely use ammonia as a shipping fuel, multidisciplinary engineers are working together, implementing rigorous design principles to ensure the safe bunkering, storage, and utilization of large volumes of ammonia targeting zero operational

emissions on open waters. This collaborative effort across industries is directly enhancing safety through inherently safe design solutions, setting new standards for product and environmental stewardship in maritime operations.



*Ammonia is a molecule composed of one nitrogen and three hydrogen atoms (NH<sub>3</sub>). For more than 100 years, ammonia has been known as a key component in fertilizer to enhance crops and ensure food production around the globe. Today, 80 percent of ammonia produced is used to bring nitrogen to plants. Tomorrow, ammonia will help us bring hydrogen to power transportation and industry as a fuel. Not only is ammonia a carbon-free chemical that does not emit CO<sub>2</sub> when burned, it can also be produced with a very low carbon footprint. Using clean ammonia in new ways will help us cut emissions all over the world.*

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